

**STS-110 (BI112)  
FLIGHT READINESS REVIEW**

**PROGRAM**

**March 26, 2002**

**Solid Rocket Booster**

## **SPECIAL TOPIC - HYDRAULIC PUMP BOLT TORQUE PRELOAD UPDATE**

**Presenter:**

Steve Gordon

**Organization/Date:**

USA-SRB/3-26-02

### New Observations

- STS-110/BI112 RH SRB tilt hydraulic pump contains three replaced inserts
  - All replaced due to documented raised condition

### Concern

- Replacement of raised insert not fully enveloped by STS-109/BI111 flight rationale
  - Could result in no preload in joint after replacement due to removal of previously failed threads

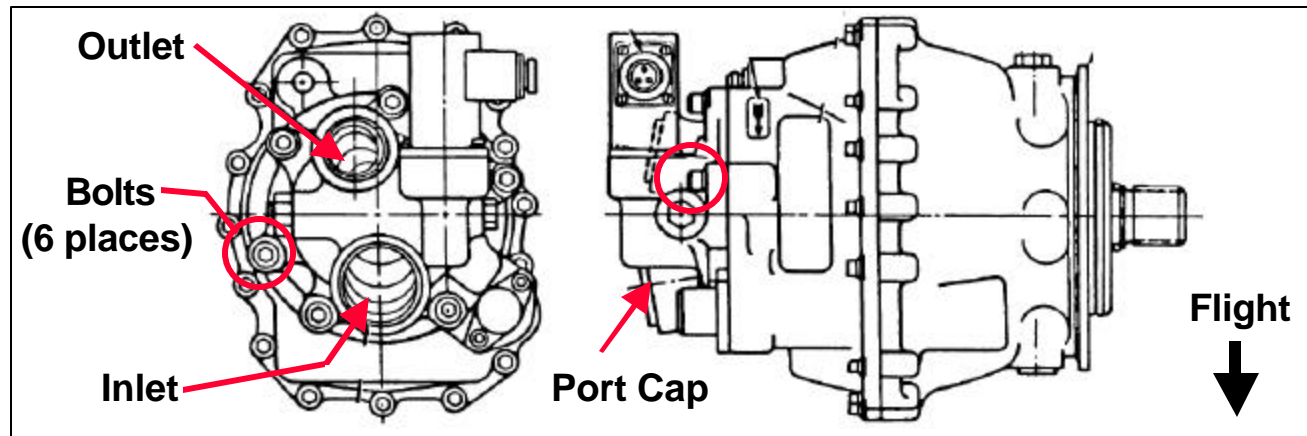
# SPECIAL TOPIC - HYDRAULIC PUMP BOLT TORQUE PRELOAD UPDATE

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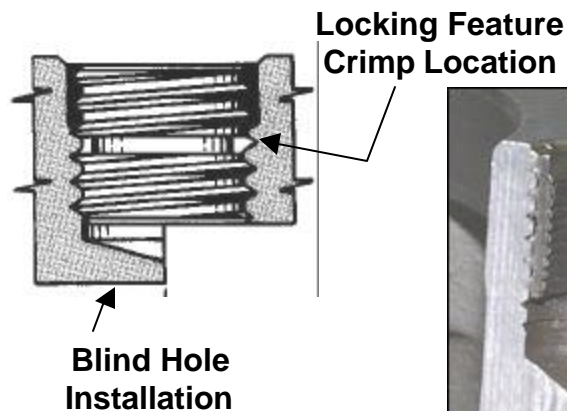
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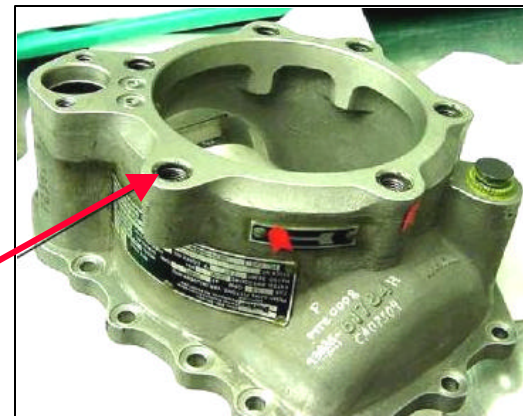
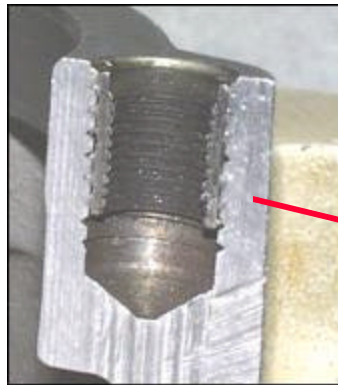
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Hydraulic Pump



Insert (6 places)



Hydraulic Pump Front Housing

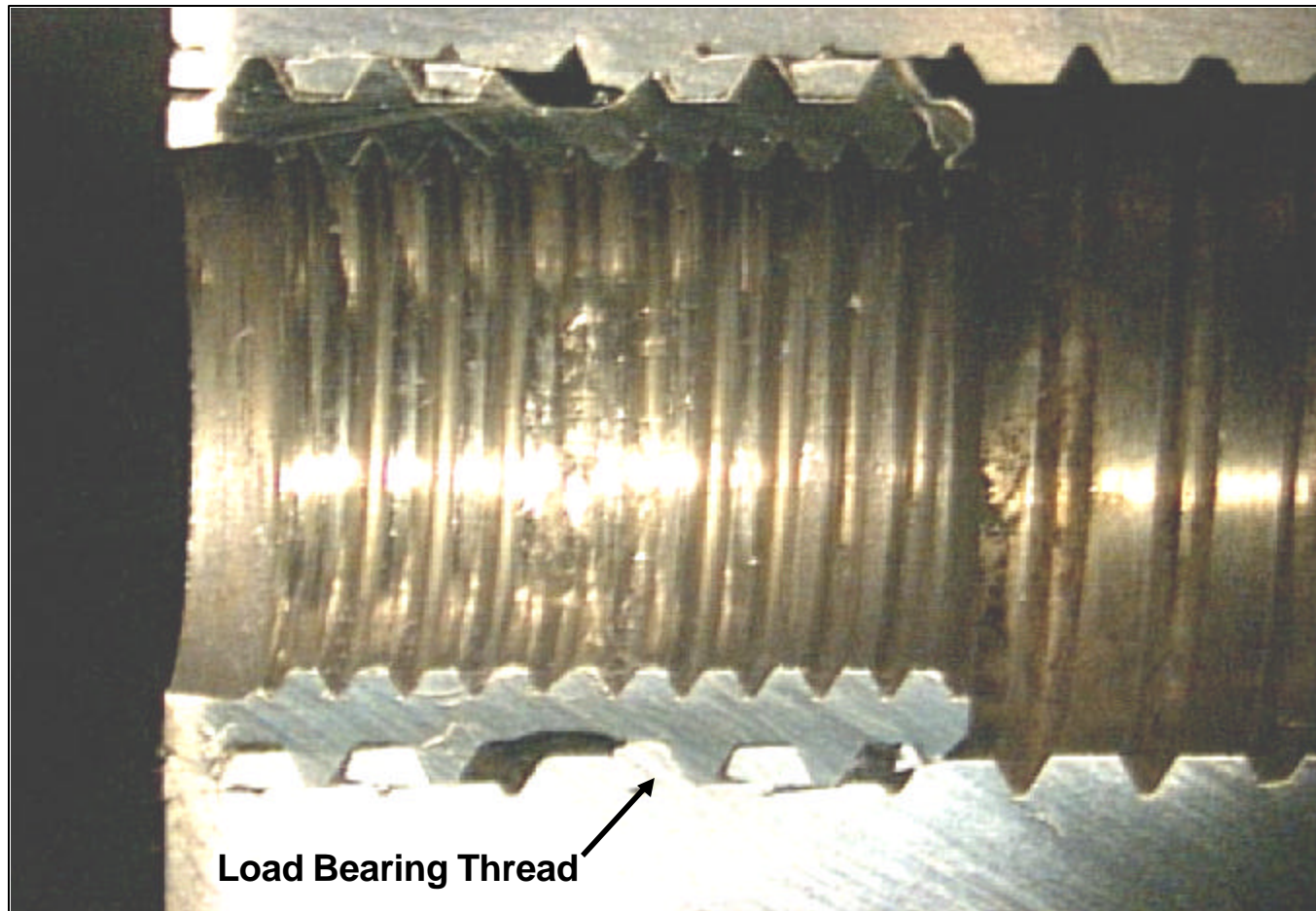
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Load Bearing Thread

**Insert/Housing Cross-Section**

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### Worst Case Failure Scenario

- Multiple insert failures allow hydraulic pump port cap separation and external release of hydraulic oil, resulting in aft skirt fire and loss of mission, vehicle and crew
  - Criticality 1

### Discussion

- Nondestructive examination of STS-110/BI112 pumps performed
  - Three SRB pumps pass NDE criteria
    - Visible gap between insert and housing
    - No gap visible, evidence of thread contact
  - X-ray review not definitive for two inserts on RH tilt pump
    - All three inserts in question raised, as suspected
    - Unable to verify housing thread configuration at two locations
    - Testing attempted at vendor to replicate worst case condition
      - Hydraulic leakage noted
    - Pump replacement and retest in work
      - X-ray results reveal no raised inserts on replacement pump

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### Discussion (cont.)

- Flight representative testing performed at KSC during ACO
  - Multiple leak checks include low/high speed spins and hot fire
- LCC ensures TVC system operation prior to lift-off
  - Hydraulic pump output pressure verified 2800 – 3486 psi
  - Reservoir level verified > 50% following APU start
- Further analysis indicates that SRB ATP proof testing fully encompasses flight dynamic loads at port cap interface

### Corrective Actions

- Design team working short and long term corrective action
- X-ray planned for all assembled pumps until corrective action in place
- Process review underway at vendor
  - Currently under stop work order

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### Rationale for Flight

- SRB pumps refurbished and successfully complete acceptance testing prior to every flight
  - Including proof pressure test
- SRB pumps successfully complete ACO testing prior to each flight
  - Including multiple leak checks and hot fire
- Analysis indicates acceptance testing loads envelope flight loads for SRB pumps
- LCC ensures satisfactory SRB TVC system performance prior to lift-off
- X-ray results show configuration of all four pumps satisfactory for flight
- STS-110/BI112 safe to fly with no increased risk

**READINESS ASSESSMENT**

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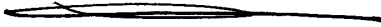
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- Pending completion of planned open work, hydraulic pump replacement and successful pump retest, there are no constraints to flight for STS-110

***STS-110 (BI112) Flight Readiness Review***

***Pending completion of normal operations flow,  
we certify the Booster Assembly hardware  
ready to support the launch of STS-110***

  
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**Gordon P. Nielsen**  
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**SRB Element**

  
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